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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/665,658	09/20/2000	Harry B. Smith	A7583	5537

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EXAMINER

JAMAL, ALEXANDER

ART UNIT	PAPER NUMBER
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2643

DATE MAILED: 04/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<p align="center">Office Action Summary</p>	Application No. 09/665,658	Applicant(s) SMITH, HARRY B.	
	Examiner Alexander Jamal	Art Unit 2643	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 October 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4,6-10,21,22,26 and 28-53 is/are pending in the application.
 4a) Of the above claim(s) 47 and 48 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 28,40-46 and 49-53 is/are allowed.
- 6) ☒ Claim(s) 1,4,8,22,26 and 29-39 is/are rejected.
- 7) ☒ Claim(s) 2,3,6,7,9,10 and 21 is/are objected to.
- 8) ☒ Claim(s) 11-20,23-25,27,47 and 48 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>11-23-2004</u> . | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)
6) <input type="checkbox"/> Other: _____. |
|--|---|

DETAILED ACTION

Response to Amendment

1. Based upon the amendment received 11-23-2004, examiner withdraws all rejections to **claims 46,49**.
2. Examiner notes that **claims 47,48** have been cancelled, and **claims 50-53** have been added.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 29,37**, rejected under 35 U.S.C. 103(a) as being anticipated by McCool et al. (4238746) and further in view of Leib et al. ('Adaptive Lattice Filter for Multiple Sinusoids in White Noise' pages 1015-1023).

As per **claim 29**, McCool discloses a receive system (Col 1 lines 10-29) comprising means (the adaptive line enhancer) to receive signals across an entire wide continuous system bandwidth. The use of multiple channels (Col 12 lines 1-9) provides a wide system bandwidth in a 'broadband' environment (Col 1 lines 10-15). The broadband

environment is the continuous system bandwidth. The line enhancer increases the signal to noise ratio of the system (Col 1 lines 10-29). Increasing the signal to noise ratio inherently allows for greater system bandwidth because the higher SNR will mean a lower error rate, and that allows for a faster data rate (higher bandwidth, or more channels) at a given error tolerance (ie. the reception of the pulsed signals are improved). With more channels used, then broadband spectrum will provide greater noise. McCool also discloses that additional communication channels may be processed with his enhancer (Broadband) (Col 12 lines 1-9). Additionally, McCool's enhancer will process any broadband noise (Col 12 lines 10-20) rapidly. The noise is processed using the signal+noise component 'X(j)' in Fig. 1. This component comprises the rapidly changing noise samples (white noise). However, McCool does not disclose the receive system without the use of a transversal filter.

McCool implements an adaptive lms algorithm on a transversal filter. Leib teaches the use of a lattice filter instead of a transversal filter to implement adaptive LMS algorithms. Leib teaches that the Lattice filter structure can be implemented in order to reduce the filter sensitivity to transients and quantization errors as compared to transversal filters (Page 1015, Col 1). It would have been obvious to one of ordinary skill in the art at the time of this application that McCool's system could be implemented without the use of a transversal filter for the advantage of allowing the system to gain the aforementioned advantages of the Lattice filter structure.

As per **claim 37**, claim rejected for the same reasons as the rejection of claim 29.

Additionally, McCool's system receives input signals comprising multiple spectral lines (channels) (Col 12 lines 1-8) that inherently comprise carrier signals for the purpose of transmitting the data in a known frequency range. McCool's system accepts the input signals (comprising the carrier signal), and uses the input signal to make noise estimates and then identifies a zero signal condition (when the error signal $e(j)$ converges on the noise estimate, there will be almost zero noise signal in the data signal) which corresponds to an optimum noise estimate (the converged iterative process).

5. **Claims 35,36** rejected under 35 U.S.C. 103(a) as being unpatentable over McCool (4238746), and further in view of Golla et al. (5724395) and further in view of Leib et al. ('Adaptive Lattice Filter for Multiple Sinusoids in White Noise' pages 1015-1023).

As per **claim 35**, McCool discloses a method to increase the signal to noise ratio in a receive system providing a sequence of an iterative process (running the delayed input signal through the filter and then updating the filter taps with an error signal based upon the filter output (Fig. 1). The iterative process comprises providing a series of value probes for each iteration (Fig 2; w_1 , w_2 ect..), and then deriving an equivalent noise level (the ' $X_{ni}(j)$ ' term in Col 10, Equation 52) by summing several iterative digital values (summation sign in Eq. 52). The cumulative sum is adjusted to be out of phase (reversed polarity) of a noise estimate so as to cancel the noise estimate at the summing junction

(Col 11 lines 3-22). However, McCool does not disclose running two iterative processes each related to a single input signal.

Golla teaches the advantage of distributing a processing load across multiple digital filters running in parallel to perform signal processing. He teaches that this allows multiple lower resolution filters to be used instead of a costlier single high resolution filter (Col 1 line 15 to Col 2 line 20). It would have been obvious to one of ordinary skill in the art at the time of this application that the iterative processing could have been done in parallel using multiple lower resolution filters for the advantage of saving cost.

McCool and Golla both implement adaptive algorithms on transversal filters. Leib teaches the use of a lattice filter instead of a transversal filter to implement adaptive LMS algorithms. Leib teaches that the Lattice filter structure can be implemented in order to reduce the filter sensitivity to transients and quantization errors as compared to transversal filters (Page 1015, Col 1). It would have been obvious to one of ordinary skill in the art at the time of this application that the system could be implemented without the use of a transversal filter for the advantage of allowing the system to gain the aforementioned advantages of the Lattice filter structure.

As per **claim 36**, McCool's system receives input signals comprising multiple spectral lines (channels) (Col 12 lines 1-8) that inherently comprise carrier signals for the purpose of transmitting the data in a known frequency range. McCool's system accepts the input signals (comprising the carrier signal), and uses the input signal to make noise estimates and then identifies a zero signal condition (when the error signal $e(j)$ converges

on the noise estimate, there will be almost zero noise signal in the data signal) which corresponds to an optimum noise estimate (the converged iterative process).

6. **Claims 1,4,8,22,26,30-34, 38-39** rejected under 35 U.S.C. 103(a) as being unpatentable over Chiu et al. (4539689), and further in view of McCool et al. (4238746), and further in view of Leib et al. ('Adaptive Lattice Filter for Multiple Sinusoids in White Noise' pages 1015-1023).

As per **claim 1**, Chiu discloses a method to increase the signal to noise ratio of a receive wireline system (data modem) (Col 1, lines 12-15). The method comprises receiving test impulse signals (ABSTRACT) on a wireline (a wireline interface is inherent to a highspeed modem). The input signals (plus noise) are then amplified (Col 4 lines 15-19) and the signals plus noise are stored in the memory device (Col 5 lines 49-55). The method further comprises forming a matrix representing the in-phase and quadrature versions of the received signals (Col 4 lines 35-39). However, Chiu does not teach to estimate the magnitude and polarity of the noise portion of the received signal, or to subtract the estimated noise value from the received signal in order to reduce the noise on the signal. Wherein the signal comprises a continuous broadband frequency spectrum exhibiting a reduction in overall system noise.

McCool teaches that an adaptive line enhancer can enhance signaling in a noise field where there is poor signal to noise ratio at the input (Col 1 lines 1-17). He teaches that to enhance received signals, the received signal and a delayed version of the received signal (in-phase and quadrature) must be iteratively processed by adaptive filter 14 (Fig. 1), and an estimate of the noise (uncorrelated) signal produced (signal e(j) in Fig. 1). The

use of multiple channels (Col 12 lines 1-9) may provide a wide system bandwidth in a 'broadband' environment (Col 1 lines 10-15). The broadband environment has a continuous system bandwidth. The noise (uncorrelated) signal is subtracted from the received signal and as such, the method filters out the uncorrelated noise (Fig 1, Col 1 lines 16-20). Additionally, although McCool does show an embodiment of the adaptive line enhancer for a narrowband signal in uncorrelated (white) noise, his use of the term 'Narrowband' refers to the bandwidth of the transmitted signal in relation to the entire spectrum of frequencies 'the broadband spectrum' that may produce 'broadband noise'. His use of 'Narrowband' refers to the bandwidth of all channels being communicated. He also states that his adaptive line enhancer would be effective in a situation with multiple non-interfering spectral lines ('channels' in a 'broadband' signal; with 'broadband' referring to the modern day definition of multiplexing and transporting multiple channels) in correlated noise (Col 12 lines 1-8). It would have been obvious to one of ordinary skill in the art at the time of this application to increase the signal to noise ratio of the wireline receiver by iteratively processing the in-phase and quadrature versions of the received signal to produce a noise estimate which is subtracted from the received signal, thereby producing a noise-reduced signal and reducing the overall system noise.

Chiu and McCool implement adaptive algorithms on transversal filters. Leib teaches the use of a lattice filter instead of a transversal filter to implement adaptive LMS algorithms (Page 1015, Col 1). Leib teaches that the Lattice filter structure can be implemented in order to reduce the filter sensitivity to transients and quantization errors as compared to transversal filters. It would have been obvious to one of ordinary skill in

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the art at the time of this application that the system could be implemented without the use of a transversal filter for the advantage of allowing the system to gain the aforementioned advantages of the Lattice filter structure.

As per **claim 4**, McCool's processing step comprises a number of value probes which alter the received signal iteratively (Fig 2; w_1 , w_2 ect..). The step further comprises producing an estimate of the noise (uncorrelated) signal ($e(j)$) in Fig. 1) is given by summing the resultant values of several iterative steps.(Col 9 lines 45-60).

As per **claim 8**, Chiu's method comprises providing processing means that do not adversely compromise the bandwidth and signal handling capabilities of the system by performing the processing on an impulse sent before the data (Col 2 lines 16-23). The time delay for processing is short (Col 2 lines 24-28). The short time delay is utilized to setup the system such that the received signal is increased and the received noise is reduced, as such, the signal-to-noise is inherently improved.

As per **claim 22**, Chiu's method comprises implementing a method of near-real time processing by providing for a fixed time delay (Col 2 lines 16-23). McCool's method comprises subtracting a noise (uncorrelated) signal estimate from the received signal (Fig 1, Col 1 lines 1620). The fact that reducing the noise of a received signal is analogous to an introduction of energy at a lower temperature in a thermal system and improves the effective entropy with each trial, in inherent to the fact that noise is being taken from the system.

As per **claim 26**, McCool's method enhances the received signal by enabling a stronger signal relative to noise by removing the uncorrelated noise signal (Col 1 lines 16-20). The fact that the method provides for longer communication distance and/or quicker access time potential is inherent in the fact that the noise of the received signal has been reduced.

As per **claims 30,31**, McCool's method selects one set of values such that the error term $e(j)$ (is closest to the noise estimate) (Col 11 lines 10-25). When $e(j)$ has converged to the noise, then the noise in the input signal is minimized and the largest signal to noise improvement is achieved. McCool's method estimates the noise portion ($e(j)$) of a received signal. This Includes all cycles of any carrier signals (the carrier signal is disclosed in Chiu: Col 3 lines 49-57). McCool's method reduces noise in the signal based upon the selected probes (filter taps). Any signal input into McCool's system (including the modulated signal disclosed in Chiu: Col 3 lines 49-57) will be noise reduced, and as such, the demodulated result signal will be formed based upon the noise reduction (which is based upon the selected probes).

As per **claims 32,33**, McCool's method comprises implementing a method of near-real time processing by providing for a fixed time delay (Col 1 lines 54-64). The process would be performed on every cycle (all cycles) of a carrier signal (The carrier signal is disclosed in Chiu: Col 3 lines 49-57). The device also adjusts the phase (modulates) the time-delayed signal iteratively such that the delayed signal is in phase with the non-delayed signal, thus the process is performed in substantially real time. The

modulation is inherently achieved such that the Nyquist criterion is satisfied for the purpose of being able to successfully recover the original data.

As per **claim 34**, McCool's iterative process is performed in a digital filter. As such the process on each cycle is inherently performed on stored samples for the reason that the samples must be stored in order to be digitally processed.

As per **claim 38**, McCool's method comprises implementing a method of near-real time processing by providing for a fixed time delay (Col 1 lines 5464) with respect to a zero phase reference (the undelayed signal). The process would be performed on every cycle (all cycles) of a carrier signal (The use of a carrier signal to transport the data is disclosed in Chiu: Col 3 lines 49-57).

As per **claim 39**, in McCool's method, the noise estimate is obtained from every complete cycle of a carrier signal (The use of a carrier signal to transport the data is disclosed in Chiu: Col 3 lines 49-57). The data is sent in pulses (inherent to the definition of digital data). The signal (comprising 'carrier' and 'data') received by the system inherently corresponds to the demodulated 'data' (absence of 'carrier') for the reason that both signals have the 'data' in common. In McCool's method the noise is reduced to a residual value which inherently provides and enhances the ability to detect the data pulses (Col 11 lines 45-56).

Allowable Subject Matter

7. Claims 2,3,6,7,9,10,21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. Claims 28,40-46,49-53 are allowed over the prior art of record

Response to Arguments

9. Applicant's arguments with respect to claims 1,29,35,37 (and all depending claims) have been considered but are moot in view of the new ground(s) of rejection.

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alexander Jamal whose telephone number is 703-305-3433. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis A Kuntz can be reached on 703-305-4708. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9306 for regular communications and 703-872-9315 for After Final communications.


CURTIS KUNTZ
PATENT EXAMINER
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AJ
March 29, 2005